

REMARKS

At the outset, applicants note that although the Examiner has withdrawn claims 8-16 from consideration as directed to a non-elected invention, new dependent claims 17 and 18 which depended from claim 1 under consideration was presented in the previous amendment of July 16, 2003. Applicants note that the Office Action of September 30, 2003 includes no rejection of claims 17 and 18. Accordingly, applicants consider claims 17 and 18 to be allowable, and by the present amendment, have rewritten claim 17 in independent form so that claims 17 and 18 should now be in condition for allowance. Further, by the above amendment, claim 1 has been amended to clarify features of the present invention in more particularly defining the size feature as being $0.5 \mu\text{m}$ or less of a pattern and to clarify the feature that the plasma is generated from the etching gas continuously during etching of the gate electrode film. That is, as described at page 8, lines 5-11 of the specification, and as illustrated in Figs. 1 and 2, microwaves are introduced from a magnetron 101 via an automatic matching apparatus 106, a waveguide 102 and a transparent window 103 into a chamber 104, while an etching gas, such as halogen gas is introduced into the chamber 104 via a gas introducing device 100 and a plasma of the gas is generated in association with the introduction of the microwaves. As illustrated in Fig. 2 which shows the gas supply in the chamber 104 and the operations of the magnetron 101 and the rf bias power supply 109 at the time of etching, as described at page 9, lines 7-12, in line (a) a gas is supplied and the gas pressure is kept constant upon start of the etching, it being noted that Fig. 2(a) shows that the gas is continuously on, and as shown in line (b) the microwave power is also continuously supplied. Thus, it is apparent that the plasma is continuously generated while etching is effected independently of turning on and off the rf bias, as set forth in dependent claim 4, such that it is apparent that the

amendments as presented in claim 1 do not raise new issues requiring further search and/or consideration.

Applicants note that the present invention is directed to the improvement of the selectivity of a fine pattern having a minimum feature size of the gate electrode film of 0.5 μm or smaller and a thickness of the underlying film of 6 nm or smaller, as described in the specification of this application, thereby providing improvement in the verticalness of the etched pattern and decrease in micro-loading. As clearly set forth in independent claim 1 and therewith the dependent claims, the present invention provides for on-off modulating the rf bias during etching of the gate electrode at a frequency of 100 Hz to 10 kHz, while applying the rf bias at a frequency of 100 kHz higher to the stage on which the sample is arranged independently of the generation of the plasma while continuously supplying an etching gas into the chamber and continuously generating a plasma from the etching gas by the supply of power during etching of the gate electrode film. Applicants submit that such features as recited in independent claim 1 and the dependent claims under rejection are not disclosed or taught in the cited art as will become clear from the following discussion.

The rejection of claims 1 and 4-7 under 35 U.S.C. 102(a) as being anticipated by U.S. Patent 5,779,925 issued to Hashimoto et al and the rejection of claims 2 and 3 under 35 U.S.C. 103(a) as being unpatentable over Hashimoto et al further in view of Jeng et al (TW 280006), such rejections are traversed insofar as they are applicable to the present claims, and reconsideration and withdrawal of the rejections are respectfully requested.

At the outset, as to the requirements to support a rejection under 35 U.S.C. 102, reference is made to the decision of In re Robertson, 49 USPQ 2d 1949 (Fed. Cir. 1999), wherein the court pointed out that anticipation under 35 U.S.C. §102 requires that each and every element as set forth in the claim is found, either

expressly or inherently described in a single prior art reference. As noted by the court, if the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if the element is "inherent" in its disclosure. To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." Moreover, the court pointed out that inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.

With regard to the requirements to support a rejection under 35 U.S.C. 103, reference is made to the decision of In re Fine, 5 USPQ 2d 1596 (Fed. Cir. 1988), wherein the court pointed out that the PTO has the burden under §103 to establish a prima facie case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. As further noted by the court, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

Furthermore, such requirements have been clarified in the recent decision of In re Lee, 61 USPQ 2d 1430 (Fed. Cir. 2002) wherein the court in reversing an obviousness rejection indicated that deficiencies of the cited references cannot be remedied with conclusions about what is "basic knowledge" or "common knowledge". The court pointed out:

The Examiner's conclusory statements that "the demonstration mode is just a programmable feature which can be used in many different device[s] for providing automatic introduction by adding the proper programming software" and that "another motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial" do not adequately address the issue of motivation to combine. This factual question of motivation is immaterial to patentability, and could not be resolved on subjected belief and unknown authority. It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher."... Thus, the Board must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency's conclusion. (emphasis added)

In applying Hashimoto et al to the claimed invention, the Examiner essentially contends that all features of claims 1 and 4-7 are disclosed by Hashimoto. Irrespective of this position by the Examiner, applicants note that in Hashimoto et al, the power source for generating the plasma is turned on and off and the electron temperature of the plasma is lowered by the turning off of the power source so as to prevent the gate insulation film from being damaged as described in Hashimoto et al, col. 10, lines 26-52, in relation to Fig. 6 and col. 3, lines 15-46, for example. More particularly, as set forth at col. 10, lines 34-38 of Hashimoto et al in connection with Fig. 6, a waveform (c) shows in a simplified form a power waveform on/off modulated and as described at col. 10, lines 39-51 of Hashimoto et al, while the power source is turned on, the electron temperature rises and it is assumed that the power service is turned off while the electron temperature rises, whereby as the power service is turned off, the electron temperature gradually lowers, and in this manner, the power source is on/off modulated and the electron temperature rises/lowers synchronously with the on/off of the power source. As described at col. 3, lines 38-46 of Hashimoto et al, according to the experiments made by the present inventor, if the plasma exciting energy is supplied periodically and intermittently and

the substrate bias is adjusted, damages to the gate insulating film were reduced remarkably as compared to when the plasma exciting energy is supplied continuously. Thus, Hashimoto et al discloses and teaches turning on and off the power source for generating the plasma to reduce damage to the gate insulating film whereas, as disclosed in the present application and now clearly set forth in claim 1, the etching of the gate electrode film is effected while continuously generating a plasma from the etching gas which is, of course, obtained by continuously supplying microwave power while on-off modulating the rf bias. Thus, the bias voltage applied to the specimen is supplied under on-off modulation control without lowering the electron temperature of the plasma while continuously supplying the plasma-generating source power and such enables fine fabrication of the gate electrode film without causing micro-loading and damage of the gate electrode film. Applicants therefore submit that claim 1 patentably distinguishes over Hashimoto et al in the sense of 35 U.S.C. 102 and should be considered allowable thereover. Applicants specifically note that while Hashimoto et al indicates that continuous power could be supplied, Hashimoto et al specifically points to the fact that continuous supply of power results in damage of the gate insulating film and therefore Hashimoto et al specifically discloses the turning on and turning off of the source power for generating the plasma to reduce damage.

Applicants note that in accordance with the present invention, the rf bias is on-off modulated, i.e. is turned on and off, whereas, applicants submit that in accordance with Hashimoto et al, while the rf bias is varied as shown in Fig. 6(e) of Hashimoto et al, the rf bias is not on-off modulated. That is, as described in the specification of this application, since the rf bias voltage is turned on-off, V_{pp} is larger as compared with V_{pp} in a continuous bias if the power is identical with that of the continuous bias. Furthermore, since the bias voltage includes the off period, the selectivity to the mask or the underlying material is not decreased, and since the ion

energy for drawing ions to the specimen can be made higher than that during a continuous bias, the directionality of ions is further improved. Accordingly, a fine pattern of $0.5 \mu\text{m}$ or less can be etched. In contradistinction, since Hashimoto et al discloses application of a continuous bias, although a varying bias, in a case where V_{pp} is increased in order to improve the direction of the ions, that is where the power is increased, the selectivity to the mask or the underlying material is decreased, so that this imposes a limit on the increase of V_{pp} . Accordingly, a limitation on increase of V_{pp} is present and it is not possible to cope with refinement as provided by the present invention. Additionally, while the Examiner refers a pattern having a both broad width and narrow width opening, Fig. 2B at col. 5, lines 23-28 of Hashimoto et al, describes a pattern of wiring stripes juxtaposed at a distance d of $0.8 \mu\text{m}$ each having a width w of $0.5 \mu\text{m}$, while Fig. 7B as described at col. 11, lines 17-20, describes a plurality of parallel stripes each having a width w of $0.6 \mu\text{m}$ and a space d of $0.6 \mu\text{m}$. Applicants note that by the present amendment, claim 1 has been amended to define a pattern having a minimum feature size of $0.5 \mu\text{m}$ or smaller, which is clearly described in the specification of this application at, for example, page 3, line 10 and page 11, lines 20 and 21. Hereagain, it is readily apparent that Hashimoto et al does not disclose or teach this claimed feature of claim 1 and therewith the dependent claims under rejection in the sense of 35 U.S.C. 102 or 35 U.S.C. 103. Accordingly, applicants submit that claim 1 and the dependent claims under rejection patentably distinguish over Hashimoto et al in the sense of 35 U.S.C. 102 and should be considered allowable thereover, noting that dependent claims 4-7, irrespective of the position set forth by the Examiner, recite features not disclosed or taught by Hashimoto et al when considered in conjunction with parent claim 1.

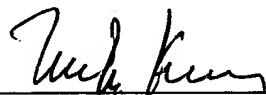
With respect to Jeng et al, irrespective of the teachings thereof, applicants submit that this reference does not overcome the deficiencies of Hashimoto et al as pointed out above, such that applicants submit that independent claim 1 and its

dependent claims 2 and 3 also patentably distinguish over the proposed combination of Hashimoto et al and Jeng et al in the sense of 35 U.S.C. 103, such that these claims should also be considered allowable at this time.

In view of the above amendments and remarks, applicants submit that in addition to claims 17 and 18 which should now be in condition for allowance, claims 1-7 under rejection in this application patentably distinguish over the cited art and should now be in condition for allowance. Accordingly, issuance of an action of a favorable nature is courteously solicited.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (520.36911VX1) and please credit any excess fees to such deposit account.

Respectfully submitted,



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